REMARKS

These remarks will discuss the claim amendments and will respond to the rejections of the office action of December 9, 2003.

A. Status of Claims:

Claims 1-153 are pending in the application. Claims 25-34 and 41-54 are withdrawn from consideration. Claims 113-117, 119, 122-124, 126, 128, 130-132, 134-140, 142-145 and 147-153 were rejected under 35 USC 102. Claims 1-24, 35-40, 55-112, 118, 120-121, 125, 127, 129, 133, 141, and 146 were rejected under 35 USC 103.

B. Claim amendments

Claims 1, 18, 55, 58, 59, 62, 67, 99, 100, 140, and 141 have been amended in this response. Claims 1, 18, 55, 62, and 67 have been amended to remove a limitation added in a previous response. Claims 58, 59, 99, 100, 140, and 141 have been amended to correct an obvious misspelling.

C. 102(e) rejections: Thomas reference does not show plasma oxidation or an oxidizing plasma

Claims 113-117, 119, 122-124, 126, 128, 130-132, 134-140, 142-145 and 147-153 are rejected under 35 USC 102(e) as anticipated by Thomas, US Patent No. 6,509, 283.

Claim 113 recites a plasma oxidation process comprising exposing an oxidizable surface to an oxidizing plasma, wherein the oxidizing plasma has an activity relative to the oxidizable surface; forming an oxide film on the oxidizable surface; and regulating the oxidizing plasma activity to limit a rate of formation of the oxide film to a predetermined growth rate while the oxidizable surface is being exposed to the oxidizing plasma.

Applicants respectfully assert that Thomas teaches *thermal* oxidation, but does not show *plasma* oxidation, nor does it teach an oxidizable or semiconductor surface exposed to a plasma.

Plasma oxidation processes are typically carried out at temperatures below about 600° C. In comparison, a conventional thermal oxidation process used to form, for example, silicon dioxide is typically carried out at temperatures in excess of 900° C. The present application describes how the lower temperature required by use of a plasma oxidation process reduces diffusion of dopants in the substrate, which enables the formation of the shallow junctions necessary for high-speed devices.

Thomas teaches a pre-heat to 500° C in the presence of an inert gas to prevent oxidation, then ramping to a second temperature, for example 1000° C, and introducing atomic oxygen to perform oxidation (col. 2, lines 39-52.) No plasma is present during oxidation. The temperature (1000° C) is appropriate for thermal, not plasma oxidation. Thomas further notes that if "an oxygen/nitrogen mixture is used, then nitrogen-doped *thermal oxide* results." (Emphasis added.) Indeed the title of the Thomas patent, "Thermal Oxidation Method Utilizing Atomic Oxygen to Reduce Dangling Bonds in Silicon Dioxide Grown on Silicon," specifies *thermal* oxidation, not plasma oxidation.

An oxygen plasma is mentioned by Thomas, but only as a method of generating the atomic oxygen introduced into the chamber for thermal oxidation. Thomas specifies that, rather than being present during oxidation, an oxygen plasma is a "remote source" of atomic oxygen, which is "then introduced into the furnace chamber containing the silicon to be *thermally* oxidized" (col. 2, lines 1-4, emphasis added; see also col. 3, lines 22-25 and Fig. 3.) That is, an oxygen plasma is created in another, remote location. This oxygen plasma generates atomic oxygen, and the atomic oxygen, not the plasma, is then introduced into the furnace chamber

where the *thermal* oxidation of silicon described by Thomas takes place. Nowhere does Thomas describe a plasma present while oxidation takes place, or exposure of the silicon surface to be oxidized to a plasma. A plasma is an ionized gas, while atomic oxygen is oxygen in its atomic form, rather than its more common molecular form (O_2).

Since Thomas does not teach exposure to an oxidizing plasma and thus fails to teach each and every limitation of the claim, Applicants respectfully request that the 35 USC 102(e) rejection of claim 113 and its dependent claims be withdrawn.

D. 35 USC 103 Rejections Relying on Thomas

Every independent claim in consideration in the present application includes the limitation of "exposing an oxidizable surface to an oxidizing plasma" (Claims 1, 72, and 113), or "exposing the semiconductor layer to a plasma comprising oxygen" (Claims 18, 89, and 130), or "exposing an oxidizable surface to a plasma oxidation process" (Claim 34), or "exposing an oxidizable surface to a plasma comprising an oxygen species" (Claims 55, 67, 96, 108, 137, and 149), or "exposing an oxidizable surface to a plasma comprising oxygen" (Claims 62, 103, and 144).

All of the 35 USC 103 rejections (of claims 1-24, 35-40, 55-112, 118, 120-121, 125, 127, 129, 133, 141, and 146) of the December 9, 2003, Office Action rely on Thomas to show oxidation by exposing a surface to a plasma. As described in Section C, Thomas does not show such plasma oxidation or exposure of the surface to be oxidized to a plasma. Thus the combination of Thomas and any of the references used in the various 35 USC 103 rejections fail to teach each and every limitation of the relevant claims, and Applicants request that they be withdrawn.

E. Thomas and Moon et al.

Claims 1-5, 7, 10-12, 14, 16, 18-20, 22-24, 35, 38-40, 55-58, 60-63 and 65-71 have been rejected under 35 USC 103(a) as being unpatentable over Thomas in view of Moon et al., US Patent Publication No. 2002/0137266. Independent claims 1, 18, 55, 62, and 67 have been amended in this response.

Claim 35 recites a process for forming an antifuse comprising exposing an oxidizable surface to a plasma oxidation process for an initial exposure time; and growing an oxide film on the oxidizable surface, and wherein the oxide film grows to a predetermined thickness at an end of the initial exposure time, and wherein additional exposure to the plasma oxidation process beyond the initial exposure time does not result in a significant further increase in thickness of the oxide film.

As described previously, this rejection relies on Thomas to show plasma oxidation, which, as explained in Section C of these Remarks, Thomas does not in fact show. Additionally, the Examiner asserts:

> However, Moon ... in figures 1-8 and related text, discloses that an oxide layer will not increase substantially beyond an initial exposure time (Figure 6).

Moon et al. do indeed teach an oxide layer not increasing substantially beyond an initial exposure time. But the oxidation of Moon et al. takes place in air at room temperature (see paragraph [0031]), not in an atomic oxygen atmosphere at 1000° C as in Thomas. It is well known that temperature and atmospheric gases dramatically alter the rate and extent of oxidation of silicon; thus the teachings of Moon et al. have no clear relevance to Thomas, and still less to the plasma oxidation process recited in independent claims 1, 18, 35, 55, 62, and 67 and their dependent claims.

Applicants can find no suggestion to combine Thomas or Moon et al. in either reference, nor has the Examiner identified any such suggestion. The extremely different conditions of oxidation would further tend to make one skilled in the art unlikely to make such a combination.

F. Conclusion

In view of these amendments and remarks, Applicants submit that this application is in condition for allowance. Reconsideration is respectfully requested. **If any objections or rejections remain, Applicants respectfully request an interview to discuss the references.** If the Examiner has any questions, he is asked to contact the undersigned agent at (408) 869-2921.

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Date

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